



North Base Garage Soil Reuse Case Study

2160 N 163rd St.
Shoreline, WA 98133

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A Sustainable Solution

Metro Transit's North Base is an operations, maintenance and bus parking facility in Shoreline, WA. Buses are primarily parked in the underground garage. On top of the garage is a green roof that consists of a two-acre, open recreation area for public use (see above photo). This recreation area has been a popular public amenity for the surrounding neighborhood.

The garage has been in use for 20 years. The waterproofing liner on the roof has passed its normal design life, and was deteriorating to the point where water was contacting the concrete roof and potentially compromising its structural integrity. Metro decided to replace the roof liner in 2012.

The green roof consists of the liner, a 4-inch layer of drainage gravel, a 6-inch layer of soil, and a top layer of grass. To replace the liner, all layers would need to be dug up. King County's Green Building and Sustainable Development policies encourage projects to reuse and recycle materials to the maximum extent practical. Metro decided to reuse the soil onsite, instead of disposing of it and purchasing new soil.

Samples of the existing soil showed that it could be reused but would need to be amended to support new grass. The existing soil was removed and stored onsite while the new liner was installed. Amendments were mixed into the soil, and then it was placed over the new liner and reseeded.

Positive Results:

- all of the nearly 3,000 tons of removed soil was reused
- 62.81 MMBTU of energy saved from not having to truck soil to a landfill
- \$122,010 saved compared to buying new soil and disposing of old soil

(See assumptions for savings on back page)

Soil Conditions and Amendment Specifications

Before amendments, the soil samples:

- were acidic
- were deficient in nitrogen, sulfate, potassium, calcium and magnesium
- had acceptable levels of salinity and sodium
- had levels of phosphorus, zinc and manganese

Recipe for amending the soil:

- Blend 80-85% existing soil with 15-20% organic amendment
- Add 1/4 lb of potassium sulfate (0-0-50) per cubic yard
- Add 2-1/2 pounds fine dolomite lime per cubic yard

When planting is completed, a nitrogen only fertilizer and slow release product will be applied at 5 pounds per 1000 square feet. In the spring and fall, a complete fertilizer should be used.



We'll Get You There



The soil was placed into a pile across the street from the site while the roof liner was replaced. Soil could not be stored on the roof due to weight restrictions.



Lighter-weight vehicles had to be used. Above, the roof with sod cleared, exposing the topsoil for removal.



The topsoil layer averaged six inches in depth. The failing roof membrane can be seen underneath the soil and drainage rock.



A photo of the soil being piled across the street from the jobsite. The contractor reduced greenhouse gas emissions, energy, and costs by having to transport the soil only a short distance across the street.

Sustainable Infrastructure Scorecard Credits Achievable Through Soil Reuse

CMc1.1: Recycle construction and demolition materials: 50% diverted

CMc1.2: Recycle construction and demolition materials: 75% diverted

CMc1.3: Recycle construction and demolition materials: 95% diverted

CMc2.0: Use on-site materials in construction

SAc4.0: Reuse native soils on-site

SMc3.1: 10% materials sourced from within 500 miles

SMc3.2: Heavy materials sourced from within 500 miles

SMc8.0: Reuse salvaged materials



The playfield once the reused soil and new hydroseed had been placed back on top of the new roof liner. All of the original soil was able to be used.

Positive Outcomes

Greenhouse Gas Emission Savings

Total emissions saved by not trucking soil:

- 5.18 MTCO₂e

Assumptions:

- 8 mpg efficiency for commercial truck
- 40 miles roundtrip to truck soil off
- 7 miles roundtrip to truck new soil in
- 24 yd³ capacity per truck

Source: <http://business.edf.org/projects/fleet-vehicles/fleet-calculator>

Energy Savings

Total energy saved: 62.81 MMBTU

Assuming: 488 gallons of diesel used to transport old and new soil

Cost Savings

Trucking costs:

- 1992 yd³ at \$40/yd³ = \$79,680

New soil cost (3-way mix):

- 1992 yd³ at \$21.25/yd³ = \$42,330

Total saved: \$79,680 + \$42,330 = \$122,010

Lessons Learned

- King County's Sustainability Ordinance successfully encouraged designers and construction contractors to identify methods that are sustainable and have lower costs.
- Spending time early on to find a way to reuse materials can save money on disposal.
- Existing soil can be economically processed onsite for reuse. Planning early is necessary to identify opportunities for reuse and adequate onsite staging areas.
- Incorporating the reuse requirements in the design specifications ensures that bidding and contracting includes sustainable construction techniques.

Challenges & Solutions

- The North Base Garage green roof playfield is not an average grassy field. It is, in fact, the largest green roof in King County. Because of its structural characteristics, there were weight restrictions for equipment and large vehicles could not be utilized.
- The contractor had to find a location to store the large pile of soil to be reused, because the roof would not support the soil in a large pile. A location across the street was found and resulted in cost savings.
- North Base is in a residential area. One concern was minimizing impact on the surrounding neighborhood. By reusing the soil, fewer trucks had to travel through the neighborhood, limiting potential disruption and noise.
- The contractor, Kassel & Associates, Inc., had to find a way to manage stormwater runoff once the soil was exposed. Their BMP's and TESC plan handled this runoff according to state and local requirements.

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